

Education, Industrial Development and Foreign Trade in Argentina: Econometric Models and International Comparisons.

Guisan, M.Carmen* (Spain), mcarmen.guisan@usc.es
y Martinez, Cintia M.(Argentina)

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Abstract

Economic policies in Argentina, during the last decades of the 20th century, were generally focused more on monetary policies than on other areas more related with economic development, such as expenditure on education and sustained industrial development, which unfortunately did not receive enough attention. In this paper, we compare the economic development of Argentina with that of the OECD countries and Latin America, and we estimate some econometric models to relate education and foreign trade with industrial and non-industrial real Gross Domestic Product per inhabitant in Argentina during the period 1960-2000. These models show the important positive impact that human capital and industrial investment have on the development of Argentina. We suggest some changes in the priorities of economic policies in the first decade of the 21st century, in order to shift focus more toward education and industrial development, by learning from the example of Ireland and other countries, to achieve a rapid increase of real Gdp per inhabitant, eradicate poverty and improve socio-economic well-being. Updated with an Annex of regional growth in Argentina and MERCOSUR.

Key Words: Economic Policies in Argentina, Economic Development in Latin America, Econometric models of Development, Industrial Development, Human capital, Expenditure on Education, Foreign Trade in Argentina, MERCOSUR

JEL classification: C5, C51, E23, I2, O11, O54

1.- Introduction

In spite of the stagnation and recession suffered by Argentina during the last decades of the 20th century, this country has a real value of Gross Domestic Product, Gdp, per inhabitant far greater than the Latin American average. Some problems are, however, common to other Latin American countries, and so the analyses of the economic problems and solutions of Argentina will also be interesting for the development of successful new economic policies to improve economic development in the other Latin American countries.

Here, we analyse the evolution of Argentina in comparison with the USA, several European Countries and countries of Mercosur. We have used several national and international sources of data and some provisional estimations, due to unavailability of official figures or to methodological changes, the result is an interesting general view which allows us to see the main features of the Argentina economy in an international perspective and to suggest realistic solutions to achieve a much needed increase in development.

* Maria-Carmen Guisan is Professor of Econometrics at the University of Santiago de Compostela, USC, (Spain) and she is President of the Euro-American Association of International Development Studies, e-mail: mcarmen.guisan@usc.es. Cintia Martinez is a graduate in Public Administration and Accounting from the Northeastern National University (Argentina), Master in International Sectoral Economics and Doctoral student at the USC in 2003. She reached a Doctoral Degree in Economics at this university in year 2004.

In this paper we want to focus on the need to improve economic policies for education expenditure and industrial investment in Argentina and other Latin American countries, as they have not yet received the priority that they deserve. Economic research results show, according to what happened in OECD countries and other international comparisons, that in general these variables are the most important factors in increasing socio-economic development in the majority of countries.

Economic development in Argentina underwent a very complex evolution during the last half of the 20th century, reaching a level of economic development lower than expected when we consider the relatively good economic conditions of this country during the period 1900-1950.

Public education expenditure and industrial investment were very low, according to the international standards of developed countries, both in Argentina and Latin America. Other variables related with economic development, such as foreign trade, also evolved very slowly in comparison with other areas that reached higher levels of development.

Section 2 presents a comparison of Argentina with the other American and European countries regarding total production, population growth, production by sector and foreign trade, as well as a comparison of regional disparities between Argentina and other countries. We include also an analysis of some of the main misconceptions about errors in economic policy in Argentina and Latin America during the second half of the 20th century, and provide suggestions for efficient economic policy with an aim to increase socio-economic development in all regions.

Section 3 presents econometric models of economic development estimated with times series data of Argentina in order to show the positive impact of education expenditure and industrial investment, as well as the relation of both variables with foreign trade and the level of real consumption per inhabitant. Finally, section 4 presents the main conclusions.

2. A comparison of Argentina with other countries

First of all we present a comparison of real Gross Domestic Product per inhabitant, Gdph, during the second half of the 20th century of Argentina and other American and European countries, secondly we present a comparison of educational level, industrial development, investment and foreign trade, thirdly we refer to the problem of regional disparities and finally we comment on the main economic challenges of Argentina at the beginning of the 21st century.

Evolution of real Gross Domestic Product per inhabitant in 1950-2000

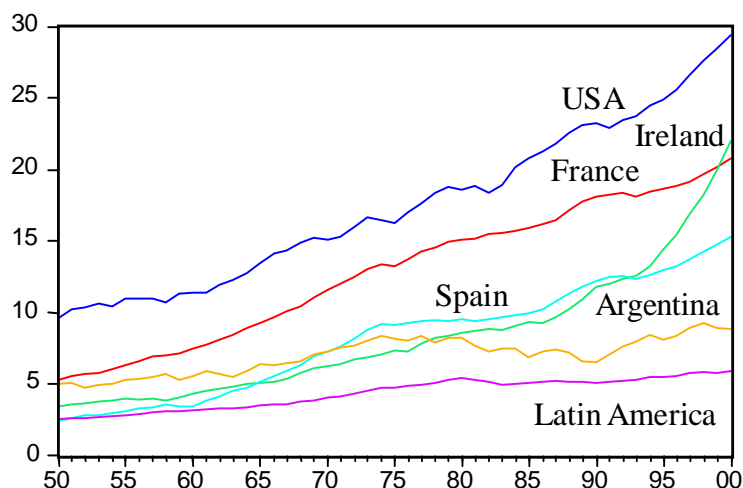
Graph 1 shows the evolution of real Gdp per inhabitant during the period 1950-2000 in Argentina in comparison with the USA, France, Spain, Ireland and the average of Latin American countries, expressed in thousands of US dollars at 1990 prices and Purchasing Power Parities, PPPs, according to data published in Maddison(2001), OECD(2001), Cepal(2002) and UN(2002).

We can see that Argentina held a clearly superior position to Spain and Ireland until 1960, but since then these two countries had continuing improvement in order to converge with the European Union average, and surpassed Argentina in the next decades: Spain since 1970 and Ireland since 1978. We can see that Ireland was below Argentina in 1950-1977, and it surpassed Argentina in 1979, Spain in 1993 and France in 1999.

Although Argentina has been clearly over Latin American average, we notice that during the period 1979-90, the economic recession in Argentina was so deep that the differences diminished.

The small recovery of real Gdp per inhabitant during the period 1990-2000, followed by negative growth rates of this variable during the period 2001-2002, was not enough to solve the important socio-economic problems of Argentina and the lack of a clear path of development led to a deep social crisis during those years. So, we suggest new priorities for economic policies, based on realistic assumptions, to achieve the desired levels of economic development.

Graph 1. Evolution of real Gdp per inhabitant
(thousands of dollars at 1990 prices and PPPs)



Tables 1 to 3 show, respectively, the evolution of Gdp, Population and Gdp per inhabitant of Mercosur countries in comparison with the USA and some European countries, based in the data by Maddison (2001) for 1950-90 and UN for year 2000. The last column of these tables show the percentage of increase during the period 1950-2000.

Table 1. Evolution of real Gross Domestic Product in Mercosur, USA and some European countries (millions of dollars at 1990 prices and PPPs)

Country	1950	1960	1970	1980	1990	2000	%Δ 50-00
Argentina	85524	114614	174972	232802	212518	321268	276
Brazil	89342	167397	292480	639093	743765	975444	992
Paraguay	2338	2970	4636	10549	13923	16740	616
Uruguay	10224	12554	14638	19205	20105	26203	156
Mercosur	187428	297535	486726	901649	990311	1339655	615
USA	1455916	2046727	3081900	4230558	5803200	8098966	296
France	220492	344609	592389	813763	1026491	1219712	453
Spain	66792	105123	246976	356062	474366	601383	800
Ireland	10231	12127	18289	29047	41459	83242	714

Source: Elaboration from data by Maddison (2001) and UN (2002).

Table 2. Evolution of Population in Mercosur, USA and some European countries
(thousands of inhabitants)

Country	1950	1960	1970	1980	1990	2000	%Δ 50-00
Argentina	17150	20616	23962	28237	32634	36191	111
Brazil	53443	71695	95684	122936	151040	170406	219
Paraguay	1371	1774	2301	3147	4317	5496	301
Uruguay	2194	2531	2824	2920	3106	3337	52
Mercosur	74158	96616	124771	157240	191097	215430	191
USA	151708	180671	205052	227757	249911	275372	82
France	41840	46163	51251	53880	56709	58892	41
Spain	27868	30583	33876	37386	38851	39466	42
Ireland	2969	2834	2950	3401	3506	3787	28

Source: Elaboration from data by Maddison (2001) and UN (2002).

Table 3. Evolution of real Gdp per inhabitant in Mercosur, USA and some European countries (dollars at 1990 prices and PPPs)

Country	1950	1960	1970	1980	1990	2000	%50-00
Argentina	4987	5559	7302	8245	6512	8877	78
Brazil	1672	2335	3057	5199	4924	5724	242
Paraguay	1705	1674	2015	3352	3225	3046	79
Uruguay	4660	4960	5183	6577	6473	7852	68
Mercosur	13024	14529	17557	23372	21135	25499	96
USA	9597	11328	15030	18575	23221	29411	206
France	5270	7465	11559	15103	18101	20711	293
Spain	2397	3437	7291	9524	12210	15238	536
Ireland	3446	4279	6200	8541	11825	21981	538

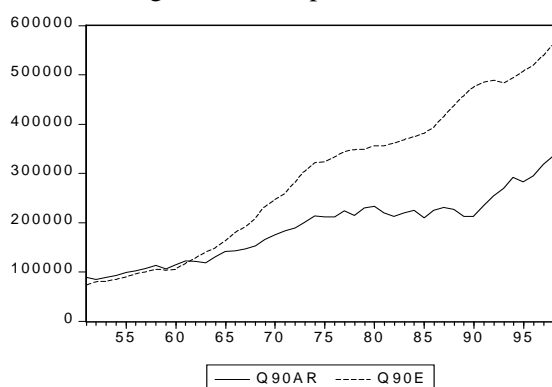
Source: Elaborated from data by Maddison (2001) and UN (2002).

In these tables the countries with the higher percentages of increases in real Gdp per inhabitant during the second half of the 20th century have been Ireland, Spain, France, Brazil and the USA, while Argentina, Paraguay and Uruguay has experienced lower increases. Thanks to the high increase in real Gdp of Brazil, Mercosur as a whole has experienced a percentage of increase in this variable higher than the USA and France, and very near to those of Spain and Ireland, but Mercosur has had a much higher population growth rate than the other countries of table 7, with an increase of 192% during the period 1950-2000, while the USA has had 92%, France 41%, Spain 42% and Ireland 28%.

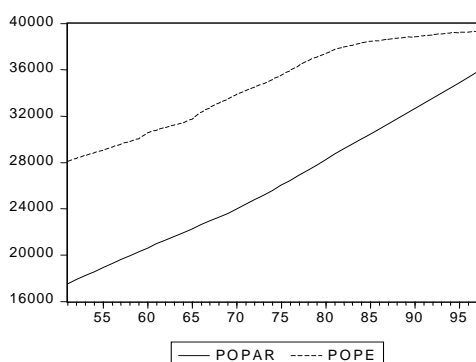
Thus our main conclusion is that the differences in the percentages of increase of Gdp per inhabitant between Mercosur and the other countries were due more to differences in population growth than to differences in the growth of real Gdp, although there are some differences among countries. The evolution was not the same in Brazil and Paraguay than in Argentina and Uruguay, because while the former have had high percentages of growth both in real Gdp and Population, the latter two countries have experienced more moderate growth in both variables. Although Argentina had been richer than Spain, in terms of Gdp per inhabitant, during the period 1900-1950, that situation changed during the period 1950-2000.

Graphs 2 and 3 show a comparison of the evolution of real Gdp at 1990 prices and purchasing power parities (Q90AR and Q90E), and Population between Argentina and Spain (POPAR and POPE), in which we can see that Argentina experienced a lower growth of Gdp and a higher growth of population.

Graph 2. Evolución of real Gdp in Argentina and Spain



Graph 3. Evolution of Population in Argentina and Spain



The different evolution of real Gdp in Spain and Argentina during the second half of the 20th century was mainly due to the educational financing and industrial investment policies, which were clearly higher in the case of Spain. This country experienced during the period 1960-2000 also some special circumstances that have contributed to economic development such as the important increase of the capacity to import raw materials and machinery due to: 1) the income from foreign tourism,

mainly from industrialized European countries, 2) exports to Europe and other areas and 3) international remittances received from the savings of Spanish emigrants to those countries. Joining European Union in 1986 has been also positive for Spain although at a lesser extent than the abovementioned circumstances. It is true that Argentina and other Latin American countries did not experienced some of those favourable circumstances, but it is clear that they could have increased more the degree of industrialization if economic policies would have been focused to give priority to this way of development.

Educational level, industry, investment and foreign trade

Table 4 presents the average total years of education of population over 15 years old, in 1960 and 1999 according to the data by Barro and Lee(2001) and the estimation of expenditure on public education per inhabitant presented in Guisan(1997) and expressed in dollar at 1995 prices and purchasing power parities, PPPs.

Table 4. Years of Education 1960-99 and Public Expenditure on education per inhabitant in 1995(dollars at 1995 PPPs).

Country	Tyr60	Tyr99	Eduh95
Canada	8.37	11.43	1620
USA	8.66	12.24	1371
Mexico	2.40	6.73	423
Andean Community	2.86	6.00	176
Chile	4.99	7.89	245
Argentina	4.99	8.49	294
Brasil	2.83	4.56	259
Paraguay	3.35	5.74	99
Uruguay	5.03	7.24	192
France	5.78	8.37	1157
Germany	8.28	9.75	1071
Ireland	6.45	9.02	1019
Spain	3.64	7.25	654

Note: Tyr is Total years of Education of population over 15 years old.

Eduh95 is public expenditure on education per inhabitant in US dollars in 1995.

Source: Barro and Lee(2000), Guisan(1997).

Although there have been important increases in the average years of education, the educational expenditure is very low in Latin America in comparison with more developed countries, and this lack of sufficient financing has had negative consequences on economic development.

Argentina stands out in comparison with other Latin American countries in average years of schooling but not in value of public expenditure on education. Some differences in private expenditure could explain part of this discrepancy, but it also may be due to a lower level of expenditure per student, which has many negative consequences. Other statistics show an evolution of public expenditure on education per inhabitant in Argentina, fluctuating between 178 and 413 1997 pesos during the period 1980-97 (Ministerio de Economía(1999).

Robbins(1999) analyses the evolution of total per capita public spending on education in Argentina in the period 1980-93 and finds that the level at the end of that period was almost the same as at the beginning, with significant decreases during the periods 1980-82 and 1987-89, some recoveries in the middle and afterwards, and from this data we can also conclude that there was little support for public expenditure on education.

The figures from the Ministry of Economy of Argentina show a real value of public expenditure on education, in 1997 pesos, of 285 in 1980, 178 in 1992, 204 in 1989, 220 in 1990 and

349 in 1997. These figures show levels of expenditure deeply below the average of Europe and the USA, as well as a slight positive trend during the period 1990-97.

Increases in expenditure on education in the cases of Spain and, particularly Ireland, in comparison with Argentina and Latin America, have implied a moderation of population growth and significant increases in industrial investment per inhabitant and development.

Education needs resources to evolve properly, not just to pay teachers adequately but also to improve availability of books and materials needed by teachers and students and to develop different types of study including in technological fields. The number of engineers and scientists in Argentina per 10,000 inhabitants around the year 1990 was only 4, similar to Brazil and other Latin American countries, and very far below 38 in the USA, 23 in France and 10 in Spain. Furthermore, improvement of higher education also favours the development of research activity not only of a technical nature, but also in socio-economics and other areas, in order to improve their contribution to economic development as seen in Guisan, Cancelo, Aguayo y Díaz(2001).

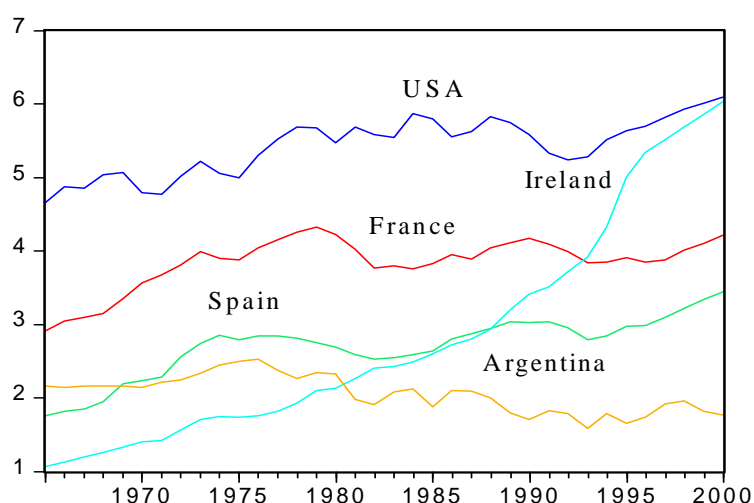
Tabla 5 and graph 4 present a comparison of industrial Gross Domestic Product in Argentina in comparison with the USA, France, Spain and Ireland, in dollars at 1900 prices and purchasing power parities.

Table 5. Industrial Gdp per inhabitant, income approach
(thousands of dollar at 1990 prices at PPPs)

obs	Argentina	USA	France	Spain	Ireland
1965	2.166	4.661	2.912	1.758	1.061
1970	2.141	4.795	3.564	2.233	1.397
1975	2.499	4.995	3.873	2.790	1.733
1980	2.320	5.470	4.221	2.695	2.132
1985	1.874	5.794	3.823	2.641	2.597
1990	1.701	5.589	4.168	3.029	3.411
1995	1.659	5.632	3.913	2.972	5.000
2000	1.765	6.096	4.210	3.443	6.029

Source: Elaborated from OECD, Indec and other statistics.

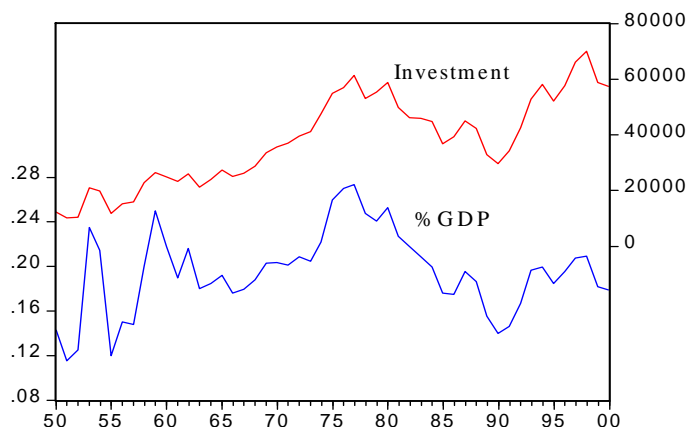
Graph 4. Industrial Gdp per inhabitant, income approach
(thousand dollars at 1990 prices and Purchasing Power Parities)



Industrial development in Argentina declined during the period 1976-90 and then experienced a high degree of stagnation in 1990-2000. We can see that Spain and Ireland, started with levels lower than Argentina in 1960 and surpassed this country during the following decades.

The relation between investment and development, given other complementary factors, is clearly dynamic, because higher levels of investment per inhabitant usually lead to higher levels of Gdp per inhabitant, and those increases favour new increases in investment and production. Investment has a role from the supply side and also a role from the demand side from a Keynesian point of view. Graph 5 shows that the real value of Gross Fixed Capital Formation in Argentina declined during the period 1977-90 not only in absolute terms but also as percentage of the Gross Domestic Product.

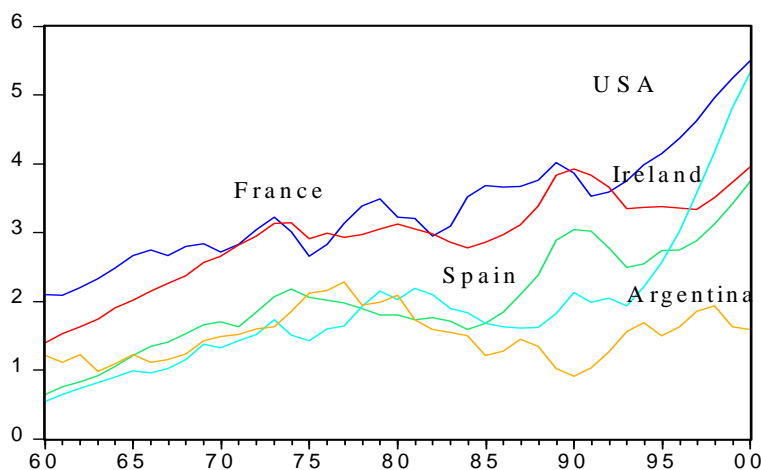
Graph 5. Gross Fixed Capital Formation in Argentina
(millions of dollars at 1990 prices and % of Gdp)



Source: Elaborated from Indec and Cepal.

In comparison with Spain and Ireland, the level of Gross Fixed Capital Formation per inhabitant in Argentina has been adequate during the period 1960-76, as seen in graph 6, followed by a downwards trend in 1976-90, recovery in 1990-94 and stagnation, with fluctuations, during 1994-2000.

Graph 6. Gross fixed capital formation per inhabitant
(thousands of dollars at 1990 prices and PPPs)



Source: Elaborated from OECD, Ined and other sources

Table 9 shows the values of Exports of goods, Expg, Services, Exps, and Total, Expt, per inhabitant, of the countries of Mercosur and the USA in the year 1998, expressed at current prices, and exchange rates, elaborated from World Bank Indicators.

Table 9. Exports of goods and Services in Mercosur
(dollars at current prices)

Country	Expg98h	Exps98h	Expt98h
Argentina	733	124	857
Brazil	310	43	353
Paraguay	194	89	283
Uruguay	846	422	1268
Mercosur	388	64	452
USA	2524	888	3881

Source: Elaborated from World Bank Indicators.

In comparison with the levels of foreign trade per inhabitant of the USA, in which total exports of goods and services per inhabitant evolved from 2100 dollars per inhabitant in 1990 to 3881 dollars in the year 1998, the countries of Mercosur show a moderate level of foreign trade, both intra-area and extra-area, with an average of only 282 dollars per inhabitant in 1990 and 452 in 1998.

International comparisons of regional disparities

Regional disparities in income per inhabitant are relatively high in Argentina with a ratio of 6.2 between Gdp per capita of the federal capital and the lowest value of provinces, corresponding to Formosa in 1991, according to the data included in Mitnik (1998).

The highest levels of Gdp per inhabitant corresponded to the City of Buenos Aires, Tierra del Fuego, San Luis, Santa Cruz, Santa Fe, Chubut y Neuquen, while the lowest levels corresponded to Chaco, Corrientes, Formosa, Santiago del Estero and Tucumán. More recent figures present similar results.

We can make some international comparison, thanks to the interesting data by Shankar and Shah (2001) and other authors, we can see that in industrialized countries the maximum/minimum ratio of regional values of Gdph varies usually between 1.7 and 3.0, showing a relatively low degree of regional disparities, while in less industrialized countries disparities are very often higher, with ratios of 3.8 in the case of India, 5.8 in the case of Mexico and 7.6 in the case of Brazil. The highest regional disparities found in that study correspond to Russia with a ratio of 21.3 in 1997 and Vietnam with 24.7 in the same year.

The degree of regional disparities in Argentina seems to be a little lower than in Brazil and a little higher than in Chile, according to the figures published by Riffo (1999), which give a ratio of 5.8 in the case of Chile.

Besides the existence of regional differences in Gdp per inhabitant, with the negatives consequences of poverty for the poorest regions, Argentina is a big country, which has a problem of excessive concentration of population in some small areas and very low density of population in many provinces.

According to the Indec (2003), density of population by squared kilometre was very low in the majority of the provinces, with the highest values equal to 59 in Tucuman, and 45 in the province of Buenos Aires (excluding the city of Buenos Aires). Only another 7 provinces have values of population density higher than 10: Catamarca 17, Córdoba 19, Corrientes 11, Entre Ríos 15, Jujuy 11, Mendoza 11, Misiones 32 and Santa Fe 23, while the other provinces have a density of population lower than 10: Catamarca 3, Chaco 9.9, Chubut 2, Formosa 7, La Pampa 2, La Rioja 3, Neuquén 5, Río Negro 3, Salta 7, San Juan 7, San Luis 5, Santa Cruz 1, Santiago del Estero 6, and Tierra del Fuego, with Antarctic and South Atlantic Islands, 5. Besides, there is a high degree of density of population in the city of Buenos Aires, with 13680 inhabitants by squared kilometre in 2001.

There is a concern about the development of regional policies, to give to citizens the opportunities of employment and to reach an adequate level of real income, in many regions, and thus

it is important to design economic policies, which have into account the positive role of education and industrial development in regional development.

Economic policies and challenges in Argentina

In the case of Argentina the moderate growth of Gdp per inhabitant was more due to the lack of increase in Gdp than to an excessive increase in population. The failure in economic growth of this country has a lot to do with mistaken economic policies during several periods.

The analysis of the different stages of economic policies and political evolution of Argentina during the second half of the 20th century shows clearly that economic and political crises have evolved together, interlinked in a complex way, with many mistaken economic policies, which have led to economic stagnation and to a high degree of social desperation. The high rates of inflation that Argentina has suffered during many years are not the cause but the consequence of the lack of efficient economic development policies.

Efficient policies should focus on improving human capital, industrial development, the quality of public services and institutions, and increasing public educational expenditure. Although some researchers have pointed out to the need of changing economic policies to get higher levels of economic development, unfortunately they were not listening to. In this regard, we could remember to Denison (1965) who so early have shown that the returns of education is usually a very important factor to explain why the growth rates of real GDP per inhabitant vary among countries.

Unfortunately, there have been several wrong and strong beliefs, supported sometimes by economic interests, and other times by pure ignorance, as it has been very well analysed by Bresser-Pereira (1999), as a rather general problem in several Latin American countries.

It is important to abandon wrong beliefs and learn from the lessons of other countries, such as Ireland, which have experienced a fast economic development process during the last decades of the 20th century.

Some of the wrong beliefs, which have lead to misleading policies in some countries, are the following:

1) *The myth of Agriculture and raw materials exports* as the main source of economic development for less developed countries, LDCs, was generally wrong, because relative prices of Agriculture products, and other raw material, in international markets have experienced important losses that should have been more analysed by economics researchers and taken into account by policy makers, as seen in Guisan and Exposito (2002) and It is important to have good policies to support this important sector but it is necessary to assume that without manufacturing investment economic growth have very short limits.

2) *The myth of “imports substitution” policy*, IS, fostering international isolation, was not good in general terms, mainly because it was developed at country level and did not improve trade among countries and large areas of Latin America. Some degree of protection at area level could have been adequate, as a starting stage to foster industrial development, but unfortunately many complementary measures to improve that lacked. When industrialization was fostered, after 1970, these countries found that high rates of Gdp growth where stopped and lowered down by foreign trade restrictions, as the impact of growth increased more imports than exports and thus it led to unbalanced foreign trade accounts and increasing foreign indebtedness.

3) *Over emphasis in monetary policies*: Both highly inflationary policies and policies that have give the main priority to the control of inflation have lacked to foster economic development, because the priority should have been in increasing industrial production per inhabitant, with the positive consequences on the development of services and the increase of real income per inhabitant. Real production should have been the main priority and monetary policies should be considered as complementary measures and not vice-versa.

4) *Under emphasis in education and social development.* The lack of adequate policies to finance and improve the level of human capital and social institutions have had important negative consequences on economic development, and it is very important to insist upon this point because unfortunately there is not yet a strong social believe in the importance of this question.

The econometric models of the next section show that the challenges for the future imply to change some priorities in economic policies of Argentina, in comparison with the second half of the 20th century, focusing on higher levels of educational expenditure, devoted to improve both general education and specialization, and industrial development, in order to achieve the desired levels of real Gdp per inhabitant, and better socio-economic conditions.

Fortunately some studies of the Argentinan economy as the interesting articles by Katz and Kosacoff(1998), Kosacoff(1998) and Heymann and Kosacoff(2000), among others, are rightly focused on economic policies adequate to foster economic development and that, together with the increase in the educational level of population will contribute positively to increase economic development in Argentina.

4.- Econometric Models of Industrial Development, Foreign Trade and Consumption

Inter-sector model of Industrial Development

Macro-econometric models should have into account both demand and supply side, particularly in countries with low level of industrialization. Keynesian, neoclassical and disequilibrium models have into account many of the explanatory variables that influence economic growth and development. Here we follow the approach by Guisan and Cancelo(1996), Guisan, Aguayo and Exposito(2001) and other researchers, who emphasize the impact of industry and foreign trade on the increase of non-industrial activities, particularly in building and services.

Firstly we estimate an inter-sector model, for Argentina during the period 1961-2000, with 4 equations, and afterwards we estimate some complementary equations for foreign trade, investment and consumption:

$$(1) \text{ QNIH} / \text{QNIH}(-1) \text{ D(QIH) D(XEDUH)}$$

$$(2) \text{ QIH} / \text{QIH}(-1) \text{ IH}$$

$$(3) \text{ IH} / \text{IH}(-1) \text{ D(QH) D(IMPH) D(XEDUH)}$$

$$(4) \text{ QH} = \text{QIH} + \text{QNIH}$$

in which QIH means real GDP in Industry per inhabitant, QNIH, real GDP per inhabitant in non-industrial sectors, XEDUH, average expenditure on Education per inhabitant during the previous years, IH Investment per inhabitant given by Fixed Capital Formation per inhabitant, QH real GDP per inhabitant of Argentina, IMPH real imports per inhabitant. All the variables are measured in thousand USD at 1990 prices and purchasing power parities, PPPs.

The source of data are official statistics from Indec, expressed by us in units similar to those of Maddison (2001), as to say at USD of 1990 according to PPPs, and our estimations for educational expenditure, and our own estimations for some unavailable data.

For industrial Gdp we have used the series from Indec but for the year 1976, when it seems to be some degree of overestimation in the original series as it is mentioned in Guisan, Gardella and Lupo (2003), and we have estimated a slightly lower value for that year.

This is a mixed dynamic model, with variables in levels expressed as a function of its own lagged value and the increases of some main explanatory variables, which usually shows best results

than models only in levels or only in first differences, and so good results as Error Component, EC model, being simpler to estimate than an EC model.

The model has interdependence among endogenous variables, because the inter-sector relations between industry and other non industrial sectors, mainly services and building, makes that increases in QIH imply increases in QNIH and consequently in IH, because this variable depends on QH, among other variables that we would include in a more detailed model, and it is expected to have a positive effect on QIH, so it should be estimated by TSLS. First of all we present equations 1 to 3 estimated by least squares, and then by two stages least squares in order to have into account the possibility of interdependence between variables and to compare the results.

Equations 1 to 3 by least squares

Equation 1. Gdp per inhabitant of non-industrial sectors

Dependent Variable: QNIH				
Method: Least Squares. Sample: 1961 2000				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
QNIH(-1)	1.001752	0.009468	105.8033	0.0000
D(QIH)	0.882340	0.327769	2.691960	0.0106
D(XEDUH)	23.79745	9.270020	2.567141	0.0144
R-squared	0.942061	Mean dependent var		5.393804
Adjusted R-squared	0.938929	S.D. dependent var		0.996266
S.E. of regression	0.246203	Akaike info criterion		0.106718
Sum squared resid	2.242791	Schwarz criterion		0.233384
Log likelihood	0.865630	Durbin-Watson stat		1.674812

Equation 2. Gdp per inhabitant in industrial sector

Dependent Variable: QIH				
Method: Least Squares. Sample: 1961 2000				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
QIH(-1)	0.992323	0.007700	128.8721	0.0000
D(IH)	0.379778	0.092818	4.091650	0.0002
R-squared	0.823192	Mean dependent var		2.067083
Adjusted R-squared	0.818539	S.D. dependent var		0.238705
S.E. of regression	0.101684	Akaike info criterion		-1.685186
Sum squared resid	0.392907	Schwarz criterion		-1.600742
Log likelihood	35.70371	Durbin-Watson stat		2.321051

Equation 3. Investment per inhabitant

Dependent Variable: IH				
Method: Least Squares. Sample: 1961 2000				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
IH(-1)	0.973475	0.013909	69.99084	0.0000
D(QH)	0.306332	0.060480	5.065031	0.0000
D(IMPH)	0.314291	0.182000	1.726869	0.0928
D(XEDUH)	6.288337	4.186466	1.502063	0.1418
R-squared	0.919680	Mean dependent var		1.511425
Adjusted R-squared	0.912987	S.D. dependent var		0.353799
S.E. of regression	0.104364	Akaike info criterion		-1.587233
Sum squared resid	0.392103	Schwarz criterion		-1.418345
Log likelihood	35.74467	Durbin-Watson stat		2.116936

Equations 1 to 3 by TSLS

TSLS estimation: Equation 1.

Dependent Variable: QNIH				
Method: Two-Stage Least Squares				
Sample: 1961 2000				
Included observations: 40				
Instrument list: QNIH(-1) QIH(-1) IH(-1) D(XEDUH) D(IMPH)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
QNIH(-1)	1.012752	0.018493	54.76344	0.0000
D(QIH)	3.990196	1.767802	2.257151	0.0300
D(XEDUH)	17.16708	17.52962	0.979318	0.3338
R-squared	0.801275	Mean dependent var		5.393804
Adjusted R-squared	0.790533	S.D. dependent var		0.996266
S.E. of regression	0.455967	Sum squared resid		7.692506
Durbin-Watson stat	1.989132			

TSLS estimation: Equation 2

Dependent Variable: QIH				
Method: Two-Stage Least Squares				
Sample: 1961 2000				
Included observations: 40				
Instrument list: QNIH(-1) QIH(-1) IH(-1) D(XEDUH) D(IMPH)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
QIH(-1)	0.992973	0.008053	123.3085	0.0000
D(IH)	0.206753	0.137456	1.504145	0.1408
R-squared	0.807023	Mean dependent var		2.067083
Adjusted R-squared	0.801945	S.D. dependent var		0.238705
S.E. of regression	0.106232	Sum squared resid		0.428837
Durbin-Watson stat	2.284503			

TSLS estimation: Equation 3

Dependent Variable: IH				
Method: Two-Stage Least Squares				
Sample: 1961 2000				
Included observations: 40				
Instrument list: QNIH(-1) QIH(-1) IH(-1) D(XEDUH) D(IMPH)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
IH(-1)	0.969698	0.016207	59.83234	0.0000
D(QH)	0.097958	0.146206	0.669998	0.5071
D(IMPH)	0.651445	0.295425	2.205112	0.0339
D(XEDUH)	10.62240	5.518074	1.925020	0.0622
R-squared	0.893196	Mean dependent var		1.511425
Adjusted R-squared	0.884296	S.D. dependent var		0.353799
S.E. of regression	0.120346	Sum squared resid		0.521393
Durbin-Watson stat	2.222646			

The problem of multicollinearity between D(QH) and D(XEDUH) increased in the TSLS estimation of equation 3, being higher than in the LS estimation, and because of that there is a problem of non significance in the coefficient of D(QH) in spite of the important positive impact of this variable in the increase of investment. We also present the LS and TSLS estimations of equation 3 excluding the variable D(XEDUH).

LS estimation of equation 3 without D(XEDUH)

Dependent Variable: IH

Method: Least Squares

Sample: 1961 2000

Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IH(-1)	0.986587	0.011011	89.60270	0.0000
D(QH)	0.333628	0.058656	5.687892	0.0000
D(IMPH)	0.322908	0.184972	1.745713	0.0892
R-squared	0.914646	Mean dependent var	1.511425	
Adjusted R-squared	0.910033	S.D. dependent var	0.353799	
S.E. of regression	0.106120	Akaike info criterion	-1.576447	
Sum squared resid	0.416677	Schwarz criterion	-1.449781	
Log likelihood	34.52893	Durbin-Watson stat	2.047830	

TSLS estimation of Equation 3 without D(XEDUH)

Dependent Variable: IH

Method: Two-Stage Least Squares

Sample: 1961 2000

Included observations: 40

Instrument list: QNIH(-1) QIH(-1) IH(-1) D(XEDUH) D(IMPH)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IH(-1)	0.988822	0.011576	85.42282	0.0000
D(QH)	0.253065	0.110288	2.294593	0.0275
D(IMPH)	0.468723	0.252903	1.853376	0.0718
R-squared	0.910295	Mean dependent var	1.511425	
Adjusted R-squared	0.905446	S.D. dependent var	0.353799	
S.E. of regression	0.108792	Sum squared resid	0.437921	
Durbin-Watson stat	2.064696			

This option shows the significance of the coefficient of D(QH), both in the LS and the TSLS estimation, and thus it implies a support for the hypothesis of interdependence in the model. The exclusion of the variable related with education expenditure has been decided in order to reduce the problem of multicollinearity but it does not mean that the variable is not relevant, because international comparisons show that educational expenditure influences positively the increase in investment per inhabitant.

The results of our model support the following conclusions:

- 1) Industrial development has an important and positive effect on non-industrial sectors.
- 2) Educational expenditure has a very positive impact both on industrial and non-industrial GDP per inhabitant.
- 3) The positive coefficient of Imports on investment equation may be due to its relation with the exports expansion and means a capacity to buy in international markets some factors of production. Foreign trade has usually a positive impact on economic development not only from the demand side (increasing exports demand), but also from the supply side (increasing the capacity to

import some raw materials, machinery or other goods and services which are productive factors needed to increase investment).

Econometric models of foreign trade

Equation 5 includes the following first differences: lagged value of foreign deficit per inhabitant, XDEFH(-1), increase in Exports of goods and services per inhabitant, EXPH, increase in investment per inhabitant, IH, and increase in total consumption per inhabitant, ZH. Foreign deficit is equal to IMPH-EXPH, and thus it has a positive value when imports, of goods and services, are higher than exports.

The results of equation 5 show the positive impact of the components of final demand, EXPH, IH, and ZH, on the demand for imports and also have into account the supply side positive relation between exports and imports capacity. The coefficients of these variables are positive, as expected, and the coefficient for the lagged value of foreign deficit is negative as expected, although it was not statistically significant. The goodness of fit is very high as it can be seen in graph 8 where we see the actual and fitted values of IMPH.

Equation 5. Real Imports per inhabitant

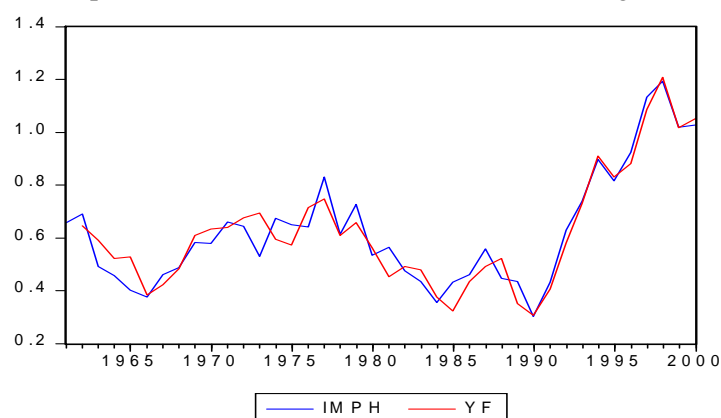
Dependent Variable: IMPH

Method: Least Squares

Sample(adjusted): 1962 2000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPH(-1)	0.971013	0.017270	56.22448	0.0000
D(XDEFH(-1))	-0.069963	0.079270	-0.882581	0.3837
D(EXPH)	0.564546	0.100747	5.603616	0.0000
D(IH)	0.176781	0.082561	2.141216	0.0395
D(ZH)	0.233936	0.049248	4.750167	0.0000
R-squared	0.917712	Mean dependent var	0.623178	
Adjusted R-squared	0.908032	S.D. dependent var	0.218296	
S.E. of regression	0.066201	Akaike info criterion	-2.473031	
Sum squared resid	0.149008	Schwarz criterion	-2.259754	
Log likelihood	53.22411	Durbin-Watson stat	2.168386	

Graph 7. Actual and fitted values of IMPH in Argentina



Equation 6 expresses real Exports of goods and services of Argentina as a linear function of the first differences of the following variables: the lagged value of foreign deficit, XDEF(-1), world real Gdp, QWLD, real total Consumption of Argentina, Z, and real Gdp of Argentina, Q. All the variables are expressed per inhabitant, dividing by the country population, indicated by the H at the end of the name of each variable.

Equation 7 expresses real Exports of goods and services per inhabitant of Argentina by means of a log-linear model in order to have into account the effect of inflation and exchange rate movements, including the first difference of the variable ($\log(\text{IPC}) - \log(\text{ER})$), where IPC is the index of price of Consumption and ER the exchange rate in relation with the USA dollar. This first difference is the difference between the rates of growth of IPC and ER.

Equation 6. Real exports per inhabitant of Argentina: linear equation
Dependent Variable: EXPH
Method: Least Squares
Sample(adjusted): 1962 2000
Included observations: 39 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPH(-1)	0.953141	0.045807	20.80768	0.0000
D(XDEFH(-1))	0.178757	0.107493	1.662963	0.1055
D(QWLD/POBAR)	0.003222	0.001881	1.713162	0.0958
D(ZH)	-0.517574	0.118065	-4.383797	0.0001
D(QH)	0.335929	0.114036	2.945820	0.0058
R-squared	0.683582	Mean dependent var		0.691590
Adjusted R-squared	0.646357	S.D. dependent var		0.164949
S.E. of regression	0.098092	Akaike info criterion		-1.686613
Sum squared resid	0.327149	Schwarz criterion		-1.473336
Log likelihood	37.88896	Durbin-Watson stat		2.547633

Equation 7. Real exports per inhabitant of Argentina: log-linear equation
Dependent Variable: LOG(EXPH)
Method: Least Squares
Sample: 1962 2000
Included observations: 39

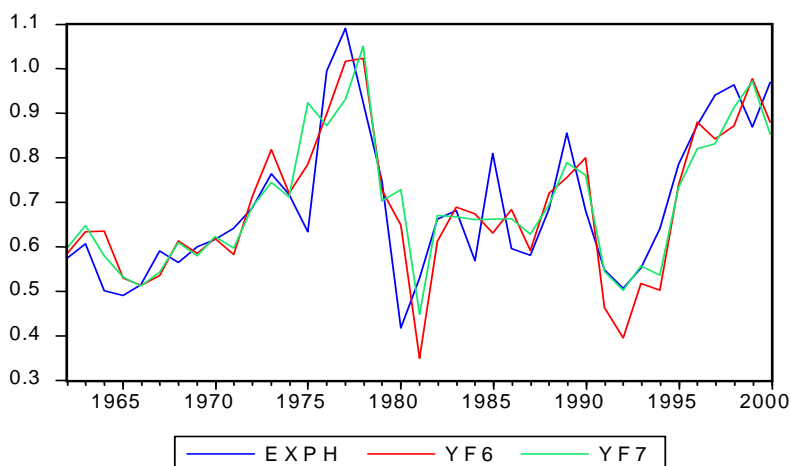
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(EXPH(-1))	0.932376	0.082539	11.29622	0.0000
D(LOG(IPC)-LOG(TC))	-0.071839	0.094415	-0.760885	0.4520
D(LOG(ZH))	-3.459383	1.047978	-3.301007	0.0023
D(LOG(PIBH))	2.503007	1.287279	1.944416	0.0602
D(LOG(QWLD/POBAR))	0.723035	1.570873	0.460276	0.6482
R-squared	0.611815	Mean dependent var		-0.395242
Adjusted R-squared	0.566147	S.D. dependent var		0.231119
S.E. of regression	0.152233	Akaike info criterion		-0.807606
Sum squared resid	0.787941	Schwarz criterion		-0.594329
Log likelihood	20.74832	Durbin-Watson stat		2.541846
SSR(EXPH)	0.368275			

Equation 6 shows, as expected, a positive impact on Exports per inhabitant, of XDEFH (-1), QWLD, and QH, and a negative impact of differences between internal prices and exchange rates as well as a negative impact, for a given level of QH, of increases in ZH.

This does not mean that increases in ZH have not positive influence in economic development, only means that increases of ZH need to be accompanied by increases in QH in order to allow an even development from demand and supply side.

The last row of the table of equation 7 shows the Sum of Squares of Residuals, SSR, for the original variable EXPH, with a value of 0.368275, while the Sum squared resid. equal to 0.793407 refers to the logarithm of EXPH. The comparison of SSR for EXPH in equations 6 and 7 shows an slightly better goodness of fit for equation 6. Graph 8 presents the actual and estimated values of EXPH according to both models, being YF6 and YF7, respectively, the fitted values of EXPH in equations 6 and 7.

Graph 8. Actual and fitted values of EXPH in Argentina



Econometric models of Consumption per inhabitant

In macro-econometric models there is usually one or more equations to explain private consumption and its component, and public consumption is treated separately, sometimes as an exogenous variable, although some econometric studies, as Guisan (2002), and Guisan and Arranz (2002) show that it is interesting to analyse together public and private consumption, specially in some components as health and education, as very often there are substitution and complementary relations among public and private expenditures.

As it is well known, total real Consumption per inhabitant, ZH, depends strongly on its own lagged value and on the first difference of real Gdp, as it is shown in equation 8 for the case of Argentina. Graph 9 shows the actual and fitted values of ZH in that equation, showing the goodness of fit of this model.

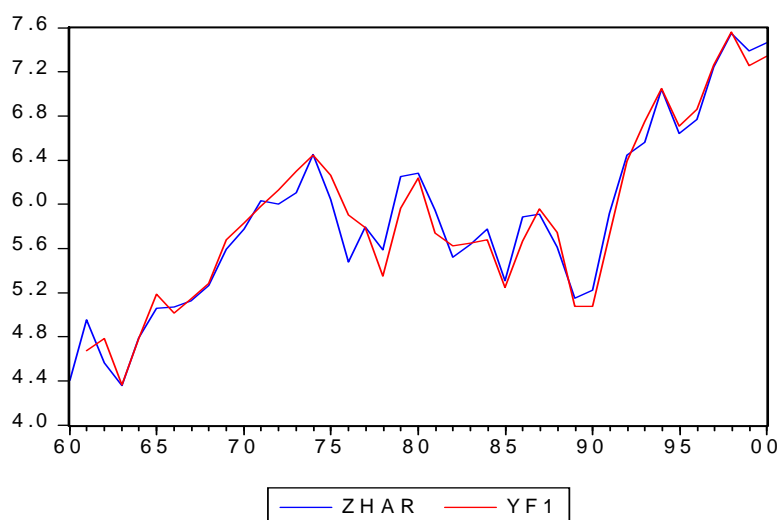
The explained variable is total consumption per inhabitant of Argentina: $zh=ch+gh$, where ch is private consumption per inhabitant and gh public consumption per inhabitant, in thousands of dollars at 1990 prices and PPPs.

Equation 8. Total real consumption per inhabitant

Dependent Variable: ZH				
Method: Least Squares				
Sample(adjusted): 1961 2000				
Included observations: 40 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ZH(-1)	0.999874	0.004184	238.9510	0.0000
D(QH)	0.902159	0.069435	12.99278	0.0000
R-squared	0.963574	Mean dependent var		5.889044
Adjusted R-squared	0.962615	S.D. dependent var		0.784168
S.E. of regression	0.151620	Akaike info criterion		-0.886178
Sum squared resid	0.873563	Schwarz criterion		-0.801734
Log likelihood	19.72355	Durbin-Watson stat		1.480877

Graph 9 shows the goodness of fit or relation 8, as we can see that actual values of real consumption per inhabitant in Argentina are very similar to those estimated by the model. All the socio-economic factors that imply increase in real Gdp per inhabitant usually lead to higher levels of real consumption per inhabitant.

Graph 10. Real total Consumption per inhabitant in Argentina
(actual values and fitted values by equation 8, thousand dollars of 1990)



Taking into account that QH depends strongly on industrial sector, we can relate ZH with QIH in equation 9, in order to consider the indirect and direct impact of the variable on the level of total consumption per inhabitant.

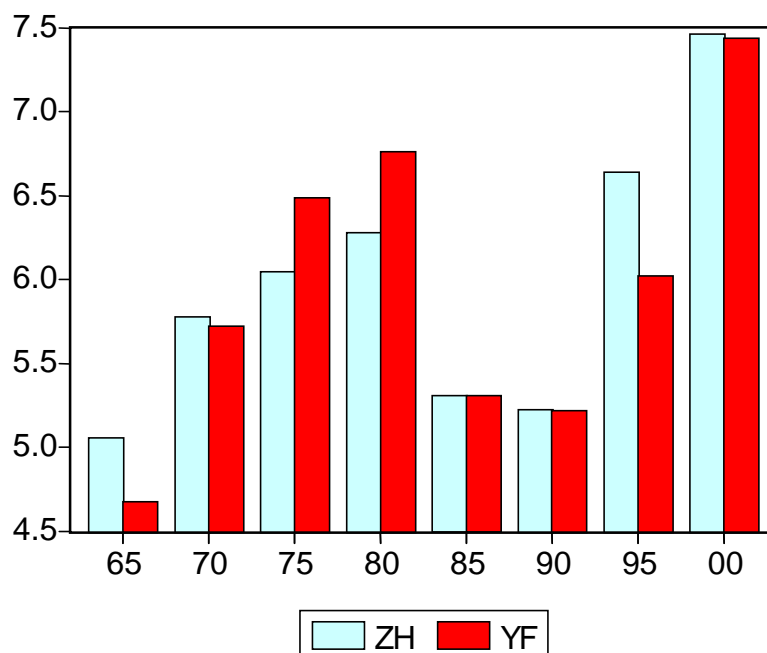
An increase of one unit in industrial development per inhabitant implies an average increase of 1.66 in real consumption per inhabitant, and so all the socio-economic variables that have a positive impact on industrial development are of great interest for improving the level of income per inhabitant in Argentina.

Although equation 8 presents a higher goodness of fit, with a percentage of S.E in relation with the mean of the dependent variable lower than 3%, we can see that equation 9 also performs very well with a percentage of S.E. lower than 5%. Equation 8 has into account not only the direct and indirect effects of industry but also the effects of other variables such as tourism which increase QH, and equation 9, although is more limited, also shows a high goodness of fit as we can see in graph 10 which presents the actual and estimated values of real consumption per inhabitant of Argentina.

Equation 9. Real consumption per inhabitant and industrial development

Dependent Variable: ZH				
Method: Least Squares				
Sample: 1961 2000				
Included observations: 40				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ZH(-1)	1.014727	0.007847	129.3129	0.0000
D(QIH)	1.662311	0.384439	4.323996	0.0001
R-squared	0.867130	Mean dependent var		5.889044
Adjusted R-squared	0.863633	S.D. dependent var		0.784168
S.E. of regression	0.289577	Akaike info criterion		0.407914
Sum squared resid	3.186478	Schwarz criterion		0.492358
Log likelihood	-6.158279	Durbin-Watson stat		1.659425

Graph 10. Consumption Expenditure per inhabitant actual and forecasted



7.- Conclusions

Some of the main conclusions from this study are the following ones:

1) The data analysed in this article show that Argentina, in spite of the difficult socio-economic and political circumstances that have experienced during the second half of the 20th century, has a level of Gdp per inhabitant clearly over Latin American average, although lower than the values of countries, such as Ireland and Spain, which have been below Argentina during the first half of the last century but which have experienced faster development during the period 1960-2000.

2) Improvement of expenditure on education and industrial development are the main factors to reach a fast increase of Gdp per capita in Argentina, not only at national level but also at regional level. Economic policies for improving regional development are of uppermost importance for Argentina.

3) Economic policies need to have into account the important impact of industrial development on the increase of real production and employment in other non-agrarian sectors. The econometric models of section 4 show the important positive impact that education and industrial development have in the increase of real Gdp per inhabitant of Argentina. Similar results have been found in econometric studies of other countries. They also show some interesting relationships between foreign trade and economic development.

4) The challenges and opportunities for Argentina during the first decades of the 21st century are very interesting and the country can get a fast economic development if socio-economic circumstances favour the development of economic policies aimed to increase educational expenditure, industrial investment and high degrees of social consensus and confidence in institutions. The success of those policies in Argentina will be indeed a positive example for other Latin American countries.

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¹ Information about the publications of the Euro-American Association of Economic Development Studies at: <http://www.usc.es/economet/eaat.htm> (English) and <http://www.usc.es/economet/aea.htm> (Spanish)

Annex on regional development in Argentina and MERCOSUR

Annex: Regional and Sectoral Growth in Argentina (Spanish version).

Note: A version in English version may be delivered under request.

Anexo 1. Análisis del crecimiento económico regional y sectorial de Argentina y otros países de MERCOSUR, 1980-2002

Anexo al Documento n° 67 de Guisán, María-Carmen y Martínez, Cintia (2003).

<http://ideas.repec.org/p/ea/ecodev/67.html>

1. Introducción.

Este Anexo ha sido incorporado con posterioridad a la versión inicial de este documento y presenta un breve resumen del análisis del crecimiento regional y sectorial, en el período 1980-2002, de los países de MERCOSUR, basado en los resultados de la Tesis Doctoral de Cintia Martínez Fedullo, titulada “Estudio econométrico regional del crecimiento económico en los países de MERCOSUR”. Directora María-Carmen Guisán, en la Facultad de Económicas y Empresariales de la Universidad de Santiago de Compostela, España, Año 2004.

2. PIB per cápita y tasas de crecimiento del PIB per cápita en MERCOSUR

En la segunda mitad del siglo XX los países de MERCOSUR con mayor tasa de crecimiento medio anual del PIB real fueron Brasil, con 5.1%, Paraguay con el 4.2% y Chile con el 4%.

El crecimiento de la población fue moderado en Uruguay, Argentina y Chile, con porcentajes menores del 2% anual. Por encima del 2% estuvieron Brasil, Paraguay y Bolivia.

La tasa exponencial del PIB per cápita es igual a la diferencia entre la tasa de crecimiento del PIB y la tasa de crecimiento de la población, y tomó los valores más elevados en Brasil, con el 2.6% anual y Chile con el 2.1%. Paraguay con el 1.5%, Argentina con el 1.4% y Uruguay con el 1.3% tuvieron crecimientos del PIB per cápita bastante moderados, y el país con el menor crecimiento fue Bolivia con el 0.6%.

Cuadro 4.2. Tasas de crecimiento promedio anual en los países del Mercosur, 1950-98

En porcentajes

	PIB p.c.	PIB	Población
Brasil	2.6	5.1	2.4
Chile	2.1	4.0	1.9
Paraguay	1.5	4.2	2.7
Argentina	1.4	3.0	1.6
Bolivia	0.6	2.8	2.2
Uruguay	1.3	2.1	0.8
MERCOSUR	1.9	4.1	2.2

Fuente: Martínez-Fedullo, C. (2004) a partir de datos de Maddison(2001)

El cuadro 6.13 presenta la evolución del PIB per cápita de los países de MERCOSUR en el período 1950-1998, según los datos de Maddison(2001), medidos en Dólares de 1990 según Paridades de Poder de Compra (PPC).

Según estos datos el conjunto de MERCOSUR tuvo un incremento del 38% en el PIB per cápita en ese período, lo cual aún siendo positivo parece insuficiente, teniendo en cuenta que otros países han logrado crecimientos mucho mayores en ese período, como es el caso de España que pasó de un nivel muy similar a la media de MERCOSUR en 1950, con 2397 Dólares de 1990 por habitante) a 14225 Dólares por habitante, lo que supone un incremento del 493%.

Cuadro 6.13. PIB per cápita, en us\$ 1990

	1950		1998
Argentina	4,987	Chile	9,757
Uruguay	4,659	Argentina	9,219
Chile	3,821	Uruguay	8,315
Bolivia	1,919	Brasil	5,459
Brasil	1,672	Paraguay	3,160
Paraguay	1,584	Bolivia	2,458
MERCOSUR	2,599	MERCOSUR	6,191

Distancias de la media del PIB per cápita del MERCOSUR, en porcentajes

	1950	1998
Argentina	192	148
Uruguay	179	134
Chile	147	158
Bolivia	74	40
Brasil	64	88
Paraguay	61	51

Fuente: En base a Maddison (2001). Los valores figuran a ppp. de 1990.

En el cuadro 4.9 observamos que las regiones argentinas con un porcentaje de Valor Añadido Bruto (VAB) superior a su porcentaje de Población, y por lo tanto con un VAB per cápita superior a la media del país en el año 2000, fueron: Buenos Aires, Patagonia, Neuquén, San Luis y La Pampa, mientras que las demás regiones tuvieron un VAB per cápita inferior a la media nacional.

Cuadro 4.9: Participación de las regiones en el total del VAB y en el total de la población, año 2000

Regiones	% sobre VAB	% sobre Pobl.
Buenos Aires	60.5	45.9
Santa Fe	7.8	8.3
Córdoba	7.6	8.5
Patagonia	4.5	3.5
Mendoza	2.6	4.4

Regiones	% sobre VAB	% sobre Pobl.
Neuquén	2.1	1.3
Entre Ríos	2.0	3.2
Tucumán	1.7	3.7
Misiones	1.6	2.6
San Luis	1.5	1.0
Salta	1.4	2.9
Chaco	1.0	2.7
Corrientes	1.0	2.6
San Juan	1.0	1.7
La Pampa	0.9	0.8
Catamarca	0.7	0.9
La Rioja	0.7	0.8
Jujuy	0.6	1.7
Santiago del Estero	0.5	2.2
Formosa	0.3	1.3
Argentina	100.0	100.0

Fuente: Elaborado por Cintia Martínez Fedullo(2004) a partir de los datos de PROVINFO(2004).

El cuadro 6.15 muestra la evolución del VAB per cápita en las regiones argentinas en 1991-2001, basados en fuentes estadísticas regionales. Se observa una disminución general en ese período, que afecta a todas las regiones excepto a Neuquén.

Cuadro 6.15. VAB per cápita, regiones argentinas, en us\$ 1999

	1991		2001
SLU	25,770	NEU	18,277
PAT	19,505	SLU	17,454
BUE	16,615	BUE	15,634
NEU	14,777	PAT	15,554
LAR	14,667	LAP	12,690
LAP	13,548	SFE	11,137
SFE	12,962	LAR	10,680
CBA	11,507	CBA	10,439
MIS	8,713	CAT	9,080
SAL	8,335	ENT	7,303
SJU	8,192	MEN	6,981
MEN	7,832	SJU	6,948
ENT	7,828	MIS	6,865
CAT	7,446	SAL	5,361
COR	6,842	TUC	5,322
TUC	6,542	COR	4,714
JUJ	6,300	CHA	4,165
CHA	5,772	JUJ	4,146
FOR	3,888	FOR	2,918
SES	3,287	SES	2,669
Argentina	13,239	Argentina	11,793

El cuadro 4.17 muestra la evolución del PIB per cápita y la Población de las regiones de Brasil en el período 1985-2000. En el caso de Brasil las regiones con PIB per cápita en el año 2000 superior a la media del país fueron: Sudeste, Sul y Centro-Oeste. Las regiones Norte y Nordeste estuvieron por debajo de la media nacional. El PIB real per cápita aumentó en todas las regiones en el período 1985-2000, pero muy poco en la región Nordeste.

Cuadro 4.17 : PIB p.c. y población regional de Brasil

PIB per capita, en us\$ de 1999			Población, en miles		
	1,985	2,000		1,985	2,000
Sudeste	6,510	7,845	Sudeste	58,104,316	72,557,215
Sul	5,164	6,880	Nordeste	39,260,372	47,820,226
Centro-Oeste	3,634	5,866	Sul	20,824,341	25,152,204
Norte	2,810	3,500	Norte	8,593,598	12,943,674
Nordeste	2,259	2,696	Centro-Oeste	8,323,289	11,669,802
BRASIL	4,655	5,789	BRASIL	135,105,916	170,143,121

Fuente: Cintia Martínez-Fedullo(2004) en base a datos del IBGE.

El cuadro 6.18 muestra el VAB per cápita de las regiones de Chile en el período 1986-2000. Observamos un crecimiento importante en el conjunto del país y en algunas regiones, como Antofagasta, que ha tenido un crecimiento de 118%

Cuadro 6.18. VAB per cápita, regiones chilenas, en us\$ 1999

	1986		2000
Magallanes	13,106	Antofagasta	23,069
Antofagasta	10,545	Tarapacá	13,199
Tarapacá	6,993	Magallanes	13,033
Metropolitana	5,846	Metropolitana	12,748
Del Libertador	5,395	Atacama	10,754
Atacama	4,656	Valparaíso	8,788
Valparaíso	4,331	Aysén	8,695
Aysén	4,192	Del Libertador	8,247
Bíobío	3,891	Bíobío	7,274
Coquimbo	3,233	De los Lagos	7,032
Del Maule	3,136	Coquimbo	6,687
De los Lagos	2,523	Maule	6,158
Araucanía	1,815	Araucanía	4,897
Chile	4,855	Chile	10,206

El cuadro 6.14 muestra el ranking del VAB per cápita de las regiones de MERCOSUR en el año 2000. Observamos un grado elevado de disparidad regional, con un ratio de casi 10 puntos entre la región más rica y las más pobres.

Cuadro 6.14. Ránking del VAB per cápita de las regiones del MERCOSUR, año 2000
En us\$ de 1999

	País	Región	VAB per cápita
1	Chile	ANT	23,069
2	Argentina	NEU	21,902
3	Argentina	SLU	21,503
4	Argentina	PAT	16,455
5	Argentina	BUE	15,898
6	Argentina	LAP	14,468
7	Argentina	LAR	13,674
8	Chile	TAR	13,199
9	Chile	MAG	13,033
10	Chile	SAN	12,748
11	Argentina	SFE	11,480
12	Argentina	CBA	11,254
13	Argentina	CAT	10,791
14	Chile	ATA	10,754
15	Uruguay	URU	10,297
16	Chile	VAL	8,788
17	Chile	AYS	8,695
18	Chile	LIB	8,247
19	Argentina	MIS	8,083
20	Argentina	ENT	8,043
21	Brasil	SUD	7,845
22	Argentina	SJU	7,735
23	Argentina	MEN	7,661
24	Chile	BIO	7,274
25	Chile	LAG	7,032
26	Brasil	SUL	6,880
27	Chile	COQ	6,687
28	Argentina	SAL	6,405
29	Chile	MAU	6,158
30	Argentina	TUC	5,958
31	Brasil	CEO	5,866
32	Argentina	COR	5,282
33	Chile	ARA	4,897
34	Argentina	CHA	4,783
35	Argentina	JUJ	4,744
36	Paraguay	PAR	4,428
37	Brasil	NOR	3,500
38	Argentina	FOR	3,386
39	Argentina	SES	3,058
40	Brasil	NES	2,696
41	Bolivia	BOL	2,358
	MERCOSUR		6.591

4. Estimación de funciones de producción para Argentina y Brasil.

Argentina

Para el período 1985-2001, se estimó una ecuación de crecimiento de tipo logarítmica (partiendo de la función de producción Cobb-Douglas), en la cual se observa el efecto conjunto que sobre el crecimiento del VAB tuvieron el empleo, la inversión, y el gasto social en salud, educación y seguridad y bienestar social y bienestar social.

La simbología utilizada es la siguiente:

VABARGT: Valor Agregado Bruto, Argentina, Total de sectores productivos. En millones de us\$ de 1999.

GSOARGT: Gasto social público (sanidad, educación, seguridad y bienestar social y vivienda). En millones de us\$ de 1999.

SKARGT: Stock de capital físico. En millones de us\$ de 1999.

LARGT: Empleo total. En miles de personas.

FICTARG: variable ficticia que recoge los efectos de las grandes crisis macroeconómicas de 1989 (la mayor hiperinflación del siglo XX en Arg.) y 2001 (caída del régimen de caja de conversión después de 10 años).

FICTHIPER: variable ficticia que recoge los efectos de las grandes crisis macroeconómicas de Argentina y Brasil.

El aditamento (-1), (-2), ...(-n-1) significa retardos de uno, dos o más periodos.

La ecuación 1 estima el crecimiento del VAB real de Argentina en función del stock de capital físico, el nivel de empleo, una variable relativa al gasto social (representativa del desarrollo social) y la variable ficticia que recoge los efectos negativos de grandes crisis económicas.

Ecuación 1

Dependent Variable: LOG(VABARGT)

Method: Least Squares

Sample(adjusted): 1986 2001

Included observations: 16 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GSOARG(-1))	0.218850	0.032747	6.683089	0.0000
LOG(SKARGT)	0.440223	0.169885	2.591298	0.0236
LOG(LARGT)	0.461489	0.269957	1.709493	0.1131
FICTARG	-0.071228	0.026050	-2.734288	0.0181
R-squared	0.943082	Mean dependent var	12.81908	
Adjusted R-squared	0.928852	S.D. dependent var	0.128192	
S.E. of regression	0.034193	Akaike info criterion	-3.701250	
Sum squared resid	0.014030	Schwarz criterion	-3.508103	
Log likelihood	33.61000	Durbin-Watson stat	1.601505	

La bondad del ajuste fue elevada, y los coeficientes tienen los signos correctos: positivos los de las tres primeras variables explicativas y negativo el de la variable ficticia representativa de las crisis económicas. Los coeficientes resultaron estadísticamente significativo, con valores de la t de Student superiores a 2.5 excepto en el caso del correspondiente al logaritmo del empleo el cual muestra bastante imprecisión, posiblemente debido a problemas de multicolinealidad.

A pesar de que no se pueda rechazar la hipótesis de nulidad de ese coeficiente, la evidencia es claramente favorable a su valor positivo ya que el intervalo de dicho parámetro, para un nivel de confianza del 95%, resulta: $0.46-2.18*0.27$; $0.46+2.18*0.27 = (-0.13; 1.05)$. Aproximadamente el 89% del intervalo de confianza de dicho parámetro corresponde a valores positivos.

La ecuación 2 estima la función de producción en términos per cápita, en función de variables explicativas en términos per cápita: stock de capital, empleo e indicador de desarrollo social.

Ecuación 2

Dependent Variable: LOG(VABARGTPC)

Method: Least Squares

Sample(adjusted): 1985 2001

Included observations: 17 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.758604	1.173346	4.055586	0.0014
LOG(GSOARGPC)	0.232464	0.029266	7.943181	0.0000
LOG(SKARGTPC)	1.006553	0.314690	3.198550	0.0070
LOG(LARGTPC)	0.731129	0.347890	2.101610	0.0556
R-squared	0.890052	Mean dependent var	9.306197	
Adjusted R-squared	0.864680	S.D. dependent var	0.084911	
S.E. of regression	0.031235	Akaike info criterion	-3.892220	
Sum squared resid	0.012683	Schwarz criterion	-3.696170	
Log likelihood	37.08387	F-statistic	35.07936	
Durbin-Watson stat	1.356427	Prob(F-statistic)	0.000002	

En la ecuación 2 los coeficientes son positivos y significativos, incluso el del logaritmo del empleo es significativo al 6% de nivel de significación y tiene un valor estimado de 0.73.

El cuadro 6.6 compara las estimaciones por Mínimos Cuadrados Ordinarios (MCO), basada en causalidad unilateral, con las correspondientes al Método de los Momentos (GMM) el cual proporciona estimadores consistentes en caso de interdependencia. Las estimaciones entre ambos métodos resultan muy similares para la ecuación 1 y muy diferentes en el caso de la ecuación 2.

Argentina

Cuadro 6.6 : Comparación entre las estimaciones obtenidas por MCO y por GMM

	Variables explicadas			
	VAB		VABpc	
<u>Variables explicativas</u>	MCO	GMM	MCO	GMM
Constante			4,76	-1.12
Gasto social (-1)	0.22	0.22	0.23	0.29
Stock de capital fis.	0.44	0.37	1,01	3.31
Empleo	0.46	0.56	0,73	0.19
Ficticia crisis	-0.07	-0.07		

Nota: todos los parámetros resultaron estadísticamente significativos, excepto los marcados con *. Todos los modelos tienen R² elevados.

Brasil

El cuadro 6.7 muestra las estimaciones MCO y GMM de una función de producción para Brasil, en la que no disponiendo de datos del stock de capital se ha incluido el incremento del capital como un indicador de esta variable. Hay que tener en cuenta que el coeficiente se ve incrementado en la misma proporción que la variable “capital” se ve disminuida al utilizar su incremento en vez del stock.

Brasil

Cuadro 6.7 : Comparación entre las estimaciones obtenidas por MCO y por GMM

<u>Variables explicativas</u>	Variables explicadas			
	VAB		VABpc	
	MCO	GMM	MCO	GMM
Constante				
Años de escolarización retardado (-1)	1.76	1.93	2.24	2.21
Stock de capital fís. (en incrementos)	15.30	14.95	16.90	18.96
Empleo	0.71	0.67		
Empleo no agrario			-1.36	-1.36
Ficticia inicio Mercos.			-0.00 *	0.09

Nota: todos los parámetros resultaron estadísticamente significativos, excepto los marcados con asterisco. Todos los modelos tienen elevados R^2 .

5. Empleo no agrario y producción sectorial

En Martínez-Fedullo(2004) se analiza la evolución del empleo no agrario y del VAB real de los sectores de industria y servicios, y se presentan los siguientes gráficos:

En los gráficos siguientes vemos la evolución del empleo no agrario en relación con el VAB del Sector Manuf. y Minero, VAB Servicios destinados a la venta y VAB total.

Graficos 6.17: Evolución del Empleo no agrario, VAB M, VABSV y VABT en Argentina, per cápita.

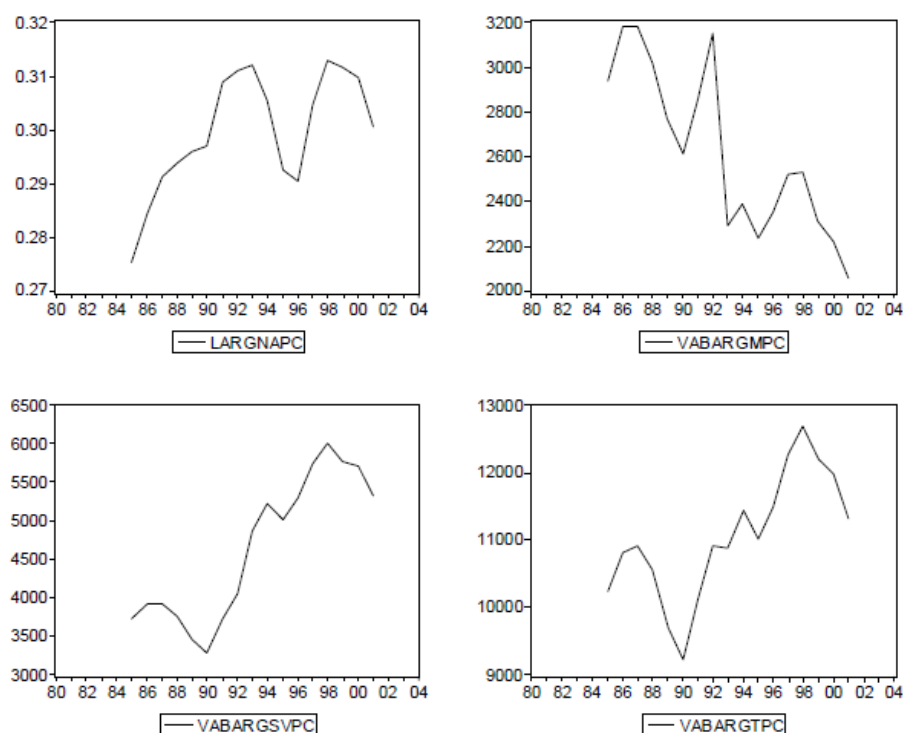


Gráfico 6.18 : Evolución del Empleo y del VAB en los sectores B y SV, per cápita, en Bolivia

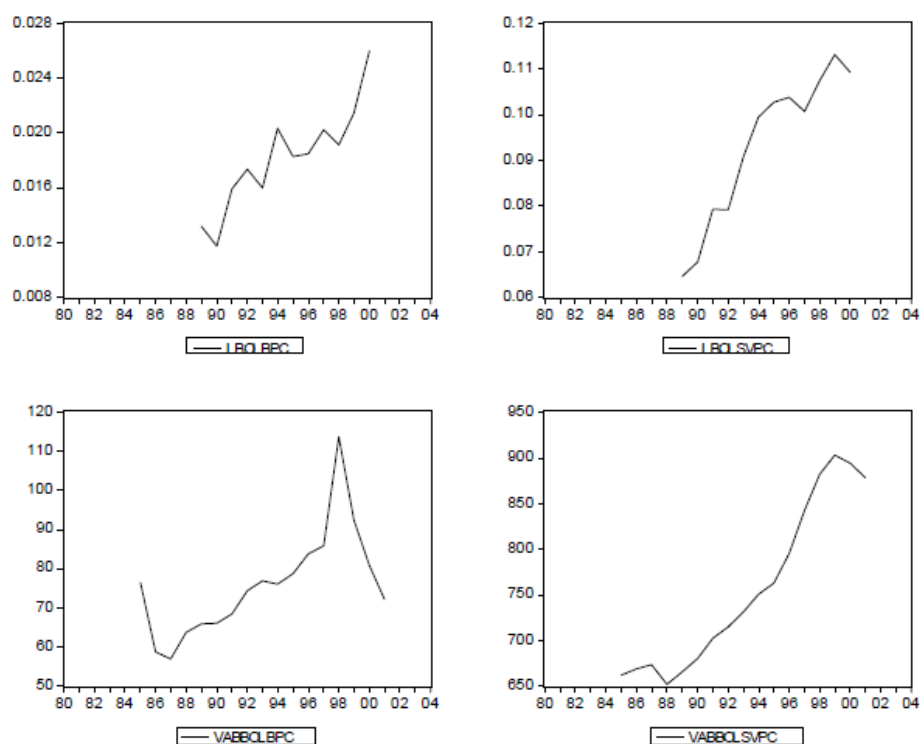


Gráfico 6.18: Evolución del Empleo y del VAB de los sectores A, M y SV y G, per cápita, en Brasil

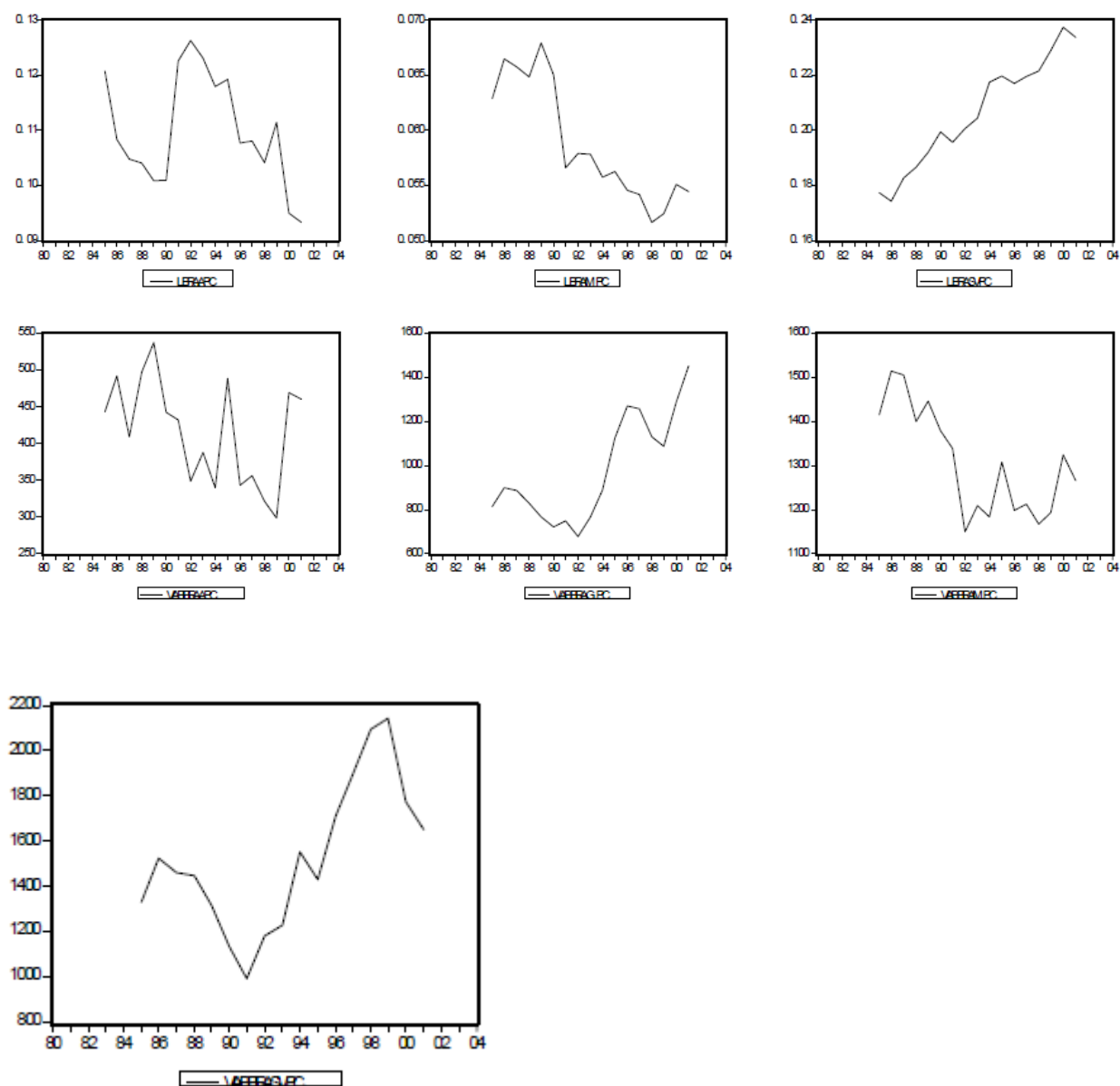
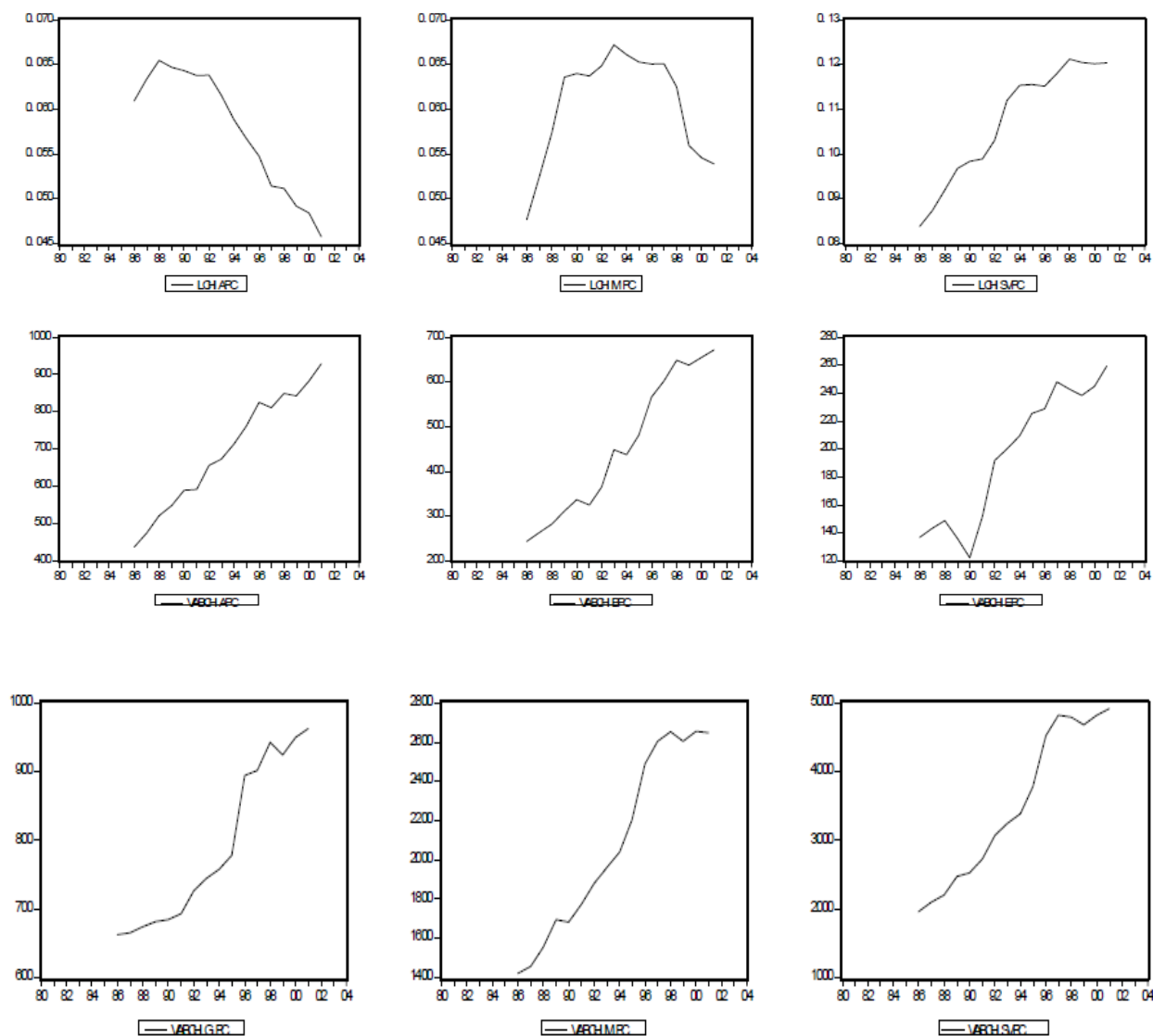
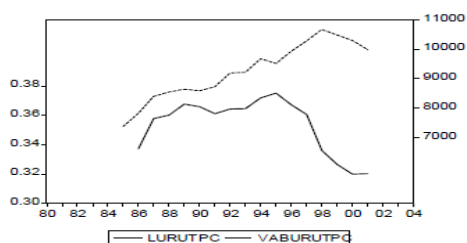


Gráfico 6.19: Evolución del Empleo y del VAB en Chile, p.c



En Uruguay, si bien el VAB total y no agrario creció durante el período, parecería que la creación de empleo no fue suficiente. Esto estaría reflejando un incremento de la productividad del factor L, que provocaron que el empleo total bajara en los años 91, 96, 97, 98 y 99. En el gráfico siguiente se puede observar la evolución comparada del empleo total per cápita (por habitante) y el VAB total per cápita (en us\$ de 1999).

Gráfico 6.20. Evolución del Empleo per cápita y del VaB per cápita (tasas por habitante y en us\$ de 1999)



6. Modelos econométricos interregionales.

Se han estimado algunos modelos con datos de panel, correspondientes a muestras de varias regiones en distintos momentos del tiempo.

En la sección 6.3 de Martínez-Fedullo(2004) se presentan los resultados de la estimación de un modelos interregional de de Argentina, Chile y Brasil:

6.3. ESTIMACIÓN DE ECUACIONES REGIONALES DE CRECIMIENTO PARA ARGENTINA, CHILE Y BRASIL

En esta sección abordamos el crecimiento y el desarrollo a nivel regional, desde la perspectiva de la función de producción, si bien otros factores de oferta y demanda también influyen en la evolución del PIB y del PIB per cápita

Entre los modelos interregionales, se encuentran los *modelos interregionales de crecimiento*, que se diferencian de los demás porque estudian básicamente las fuentes de desarrollo de las regiones, mientras que los otros modelos interregionales estudian los flujos macroeconómicos entre las regiones. Estos últimos fueron los primeros modelos multiregionales, como los estadounidenses de Harris de 1970 y 1980, el modelo Milne-Adams-Glickman de 1980, el modelo canadiense de D'Amours et al de 1979 o el de Funck y Rembold de 1975 para las regiones alemanas.

Como señalan Guisán et al (2001⁴), para que los modelos interregionales presenten buenas estimaciones es necesario que los parámetros sean bastante estables a lo largo de las regiones. Aunque los parámetros no suelen tener homogeneidad total en el tiempo y en el espacio, en muchos casos puede considerarse que la heterogeneidad existente no supera el 1% del valor del parámetro que se tome como referencia y estimar el modelo considerando que existe homogeneidad aproximada.

Ecuación 15

Dependent Variable: LOG(VAB?TPC)

Method: Pooled Least Squares

Date: 12/07/04 Time: 06:42

Sample(adjusted): 1991 2001

Included observations: 11 after adjusting endpoints

Number of cross-sections used: 20

Total panel (balanced) observations: 200

Convergence achieved after 11 iteration(s)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(PS2?(-1))	0.105211	0.094916	1.108467	0.2692
LOG(SK?TPC)	0.860258	0.035100	24.50883	0.0000
LOG(L?TPC)	0.241283	0.115413	2.090615	0.0380
FICTCRISIS	-0.013861	0.005711	-2.427182	0.0162
R-squared	0.991122	Mean dependent var		9.058551
Adjusted R-squared	0.989962	S.D. dependent var		0.548824
S.E. of regression	0.054986	Sum squared resid		0.532124
F-statistic	854.3153	Durbin-Watson stat		1.627210
Prob(F-statistic)	0.000000			

La variable FICTCRISIS es una ficticia que recoge los efectos de las hiperinflaciones en Argentina y Brasil; su inclusión mejora la estimación de los demás parámetros. La simbología utilizada en los modelos regionales es la misma que la de los nacionales.

La variable PS2 rezagada un período no resulta estadísticamente significativa mediante MCO, pero sí mediante MC2E. En ambos casos, el efecto es positivo.

Respecto al importante impacto positivo de la educación, medido por la variable PS2, hay que destacar que su impacto generalmente afecta al VAB real per cápita y no al VAB total. Sobre los efectos directos e indirectos de la educación en las funciones de producción pueden verse los estudios de Neira y Guisán(2004) y Guisán y Neira(2006).

7. Conclusiones

Destacamos algunas de las conclusiones del estudio de Martínez-Fedullo(2004) que estamos resumiendo

11. En Argentina, entre 1991 y 2001, el ranking de VAB p.c. de las regiones no ha variado mucho. 5 de 20 regiones se ubican por encima de la media (us\$ 11.793): Neuquén, San Luis, Buenos Aires, Patagonia y La Pampa, que son también las regiones que destacan en stock de capital y nivel de empleo. Estas regiones se ubican geográficamente: 2 en el centro-oeste del país, 2 en el centro-este del país y una en el sur. En el caso de Argentina, las diferencias educativas no siempre influyen en el nivel de desarrollo, debido a otros factores de aislamiento, infraestructura, etc.

12. En Chile, tanto en 1986 como en el 2000, 5 de 13 regiones se ubicaban por encima de la media (us\$ 10.206): Antofagasta, Tarapacá, Magallanes, Metropolitana de Santiago y Atacama. Excepto por un cambio de posiciones entre el 5 y 6º lugar, las regiones más ricas siguen siendo las mismas. Estas regiones son también las que han recibido mayor inversión, tienen mayor nivel de empleo y de gasto social por habitante. Estas regiones se ubican geográficamente: 3 en el norte, 1 en el centro y 1 en el sur.

13. En Brasil, entre 1985 y 2000, las 2 regiones (de cinco) de mayor VAB p.c. siguen siendo la Sudeste y la Sul. La región Centro-Oeste, que ya ocupaba el 3º lugar en 1985, ha superado la media nacional en el 2000 (us\$ 5789).

17. El desarrollo del sector no agrario está muy relacionado, en general, con el del sector industrial. Este último es un factor de crecimiento importantísimo, porque permite el crecimiento a largo plazo de las economías. Esto ya había sido defendido por K. Gupta (1971), Chenery y Taylor (1968) y en particular para los países de nuestro estudio y más recientemente, por Elías (1992), Baer (1995), Kosacoff (1998) y Guisán y Martínez (2003).

28. El sector industrial produce un efecto *spill-over* sobre el resto de la economía. Para este período, se verifica positivamente para Chile. En los demás países, la hipótesis se verifica por su ausencia: es el caso del resto de los países, quienes no apostaron al desarrollo del sector industrial en este período.

31. Entre las políticas de desarrollo regional, el incremento del nivel educativo de la población y el desarrollo del sector industrial (teniendo en cuenta las posibilidades de complementación entre regiones del mismo país y entre las regiones de todo el Mercosur) nos parecen prioritarias. Esto también contribuirá en el largo plazo al mejoramiento de las instituciones y al mejor uso del gasto público.

32. El incremento del nivel educativo contribuye a una disminución en las tasas de crecimiento de la población (Guisán, Aguayo y Expósito, 2001). El control de la natalidad en países como Brasil y Paraguay, es prioritario para mejorar los actuales niveles de PIB p.c. , pues como se vio, ambos países crecieron en PIB total a tasas superiores a la media del MERCOSUR; sin embargo, las elevadas tasas de crecimiento demográfico mantienen aún a estos países por debajo de la media en PIB p.c. de la región.

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